In the Claims

Applicant has submitted a new complete claim set showing marked up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing.

1. (Cancelled)

2. (Currently Amended) A method comprising:

establishing a stream of polymeric material flowing at a rate of at least about 5 lbs per hour within a polymer processing space between a rotating screw and an extruder barrel;

introducing, into the stream of polymeric material, a blowing agent through a plurality of orifices of the extruder barrel while passing the orifices with a flight of the rotating screw; and

admixing the polymeric material and the blowing agent to form a single-phase solution of polymeric material and blowing agent, wherein the blowing agent is present in the single-phase solution in an amount less than about 80 percent saturation concentration as determined at the lowest pressure in the extruder barrel after the point of blowing agent injection and prior to nucleating the single-phase solution.

3-10. (Cancelled)

11. (Previously Presented) A method comprising continuously extruding microcellular polymeric material from a single-phase solution of polymeric material and blowing agent contained in extrusion apparatus including a nucleating pathway, the blowing agent present in the solution in an amount less than about 80 percent saturation concentration as determined at the lowest pressure in the system after the point of blowing agent injection prior to the nucleating pathway.

12. (Currently Amended) A method comprising:

providing a single-phase solution of polymeric material and blowing agent, wherein the blowing agent is present in the single-phase solution in an amount less than about 80 percent

saturation concentration as determined at the lowest pressure in the extruder barrel after the point of blowing agent injection and prior to nucleating the single-phase solution; and

continuously extruding said single-phase solution through an orifice constructed and arranged to provide a microcellular polymeric material having an average cross-sectional dimension of less than 0.5 mm.

13. (Cancelled)

14. (Previously Presented) The method of claim 2, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

15. (Cancelled)

16. (Previously Presented) The method of claim 2, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a rate sufficient to form microcellular polymeric material.

17. (Previously Presented) The method of claim 2, wherein the flight of the rotating screw passes each orifice at a rate of at least 1 pass per second.

18. (Currently Amended) A ~~The~~ method ~~of claim 2,~~ comprising:

establishing a stream of polymeric material flowing at a rate of at least about 5 lbs per hour within a polymer processing space between a rotating screw and an extruder barrel;

introducing, into the stream of polymeric material, the blowing agent through at least about 10 orifices of the extruder barrel while passing the orifices with a flight of the rotating screw; and

admixing the polymeric material and the blowing agent to form a single-phase solution of polymeric material and blowing agent.

19. (Previously Presented) The method of claim 2, comprising introducing, into the stream of polymeric material, the blowing agent through at least about 100 orifices.

20. (Previously Presented) The method of claim 2, wherein at least some of the orifices are located at different radial positions around the extruder barrel.

21. (Previously Presented) The method of claim 2, comprising passing the orifices with an un-broken flight of a screw.

22. (Previously Presented) The method of claim 2, wherein the flight of the rotating screw periodically blocks each orifice.

23. (Previously Presented) The method of claim 2, wherein the blowing agent is a supercritical fluid in the extruder barrel.

24. (Previously Presented) The method of claim 2, further comprising extruding the single-phase solution to form a microcellular polymeric material.

25. (Previously Presented) The method of claim 24, further comprising nucleating the single-phase solution while extruding the solution through a die.

26. (Previously Presented) The method of claim 25, wherein the pressure drop rate increases in a downstream direction, while extruding the solution through the die.

27. (Previously Presented) The method of claim 2, further comprising metering the mass of the blowing agent introduced into the stream of polymeric material.

28. (Previously Presented) The method of claim 2, wherein the stream of fluid, polymeric material is established in the extruder at a rate of at least about 40 lbs per hour.

29-36. (Cancelled)

37. (Previously Presented) The method of claim 11, comprising continuously extruding microcellular polymeric material having cells of less than about 50 microns average size.

38. (Previously Presented) The method of claim 11, comprising maintaining the stream, downstream of blowing agent injection location and upstream of the nucleation region, within the extruder, under pressure not less than about 2000 psi and not greater than about 4500 psi.

39. (Previously Presented) The method of claim 11, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation by passing the solution through the nucleating pathway.

40. (Previously Presented) The method of claim 11, wherein the nucleating pathway is located within a die of the extrusion apparatus and further comprising nucleating the solution while extruding the solution through the die.

41. (Previously Presented) The method of claim 12, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

42. (Cancelled)

43. (Previously Presented) The method of claim 12, comprising nucleating the solution while extruding the solution through a die.

44. (New) The method of claim 2, further comprising nucleating the single-phase solution to form a polymeric foam material

45. (New) The method of claim 2, further comprising:

nucleating the single-phase solution at a rate sufficient to form a microcellular polymeric material; and

forming a microcellular polymeric material.

46. (New) The method of claim 45, wherein the microcellular polymeric material includes cells of size less than about 100 microns.

47. (New) The method of claim 45, wherein the microcellular polymeric material has an average cell size of less than about 50 microns.

48. (New) The method of claim 45, wherein the microcellular polymeric material has a maximum cell size of about 100 microns.

49. (New) The method of claim 45, wherein the microcellular polymeric material has a maximum cell size of about 50 microns.

50. (New) The method of claim 45, wherein the microcellular polymeric material has a void fraction of less than about 50%

51. (New) The method of claim 45, wherein the microcellular polymeric material has a void fraction of less than about 20%

52. (New) The method of claim 45, wherein the microcellular polymeric material is essentially closed-cell.

53. (New) The method of claim 45, wherein the microcellular polymeric material has a moisture absorption of less than about 0.1% by weight.

54. (New) The method of claim 45, wherein the blowing agent concentration is less than about 4% by weight based on the weight of the polymeric material and blowing agent solution.

55. (New) The method of claim 54, wherein the blowing agent is carbon dioxide and the polymeric material is substantially free of a nucleating aid.

56. (New) The method of claim 45, wherein the blowing agent concentration is less than about 2% by weight based on the weight of the polymeric material and blowing agent solution.

57. (New) The method of claim 56, wherein the blowing agent is carbon dioxide and the polymeric material is substantially free of a nucleating aid.

58. (New) The method of claim 45, wherein the blowing agent concentration is less than about 0.5% by weight based on the weight of the polymeric material and blowing agent solution.

59. (New) The method of claim 58, wherein the blowing agent is nitrogen and the polymeric material is substantially free of a nucleating aid.

60. (New) The method of claim 45, wherein the polymeric material is substantially free of a nucleating aid.

61. (New) The method of claim 45, comprising forming the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel.

62. (New) The method of claim 61, further comprising cooling the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel.

63. (New) The method of claim 45, comprising:

forming the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel;

cooling the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel; and

nucleating the single-phase solution by passing the single-phase solution through a nucleating pathway in a die and releasing from the die into ambient conditions a microcellular polymeric material.

64. (New) The method of claim 63, comprising introducing, into the stream of polymeric material, the blowing agent through at least about 10 orifices.

65. (New) The method of claim 63, wherein the pressure after the point of blowing agent injection and prior to nucleating the single-phase solution varies by no more than about 1500 psi.

66. (New) The method of claim 63, wherein the blowing agent is carbon dioxide and the polymeric material is polystyrene.

67. (New) The method of claim 45, wherein the pressure after the point of blowing agent injection and prior to nucleating the single-phase solution varies by no more than about 1500 psi.

68. (New) The method of claim 45, further comprising dividing the single-phase solution into separate portions and separately nucleating the separate portions at a rate sufficient to form a microcellular polymeric material.

69. (New) The method of claim 68, further comprising re-combining the separate portions.

70. (New) The method of claim 69, further comprising forming the microcellular polymeric material from the re-combined separate portions.

71. (New) The method of claim 70, wherein the microcellular polymeric material forms an article having a thickness of less than about 4 mm.

72. (New) The method of claim 45, wherein forming the microcellular polymeric material comprises extruding microcellular polymeric material as a coating around a wire.

73. (New) The method of claim 72, wherein the coating is less than about 4 mm.

74. (New) The method of claim 72, wherein the coating is less than about 0.1 mm.

75. (New) The method of claim 2, further comprising dividing the single-phase solution into separate portions and separately nucleating the separate portions.

76. (New) The method of claim 2, comprising introducing, into the stream of polymeric material, the blowing agent through at least about 10 orifices.

77. (New) The method of claim 2, wherein the blowing agent comprises carbon dioxide.

78. (New) The method of claim 2, wherein the blowing agent comprises nitrogen.

79. (New) The method of claim 2, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 1.0 GPa/sec to create sites of nucleation.

80. (New) The method of claim 2, wherein the same type of blowing agent is introduced through each of the ports.

81. (New) The method of claim 25, comprising nucleating the single-phase solution by passing the solution through a single nucleating pathway in the die

82. (New) The method of claim 81, further comprising releasing the nucleated single-phase solution from the die into ambient conditions.

83. (New) The method of claim 11, wherein the microcellular polymeric material includes cells of size less than about 100 microns.

84. (New) The method of claim 11, wherein the microcellular polymeric material has a maximum cell size of about 100 microns.

85. (New) The method of claim 11, wherein the microcellular polymeric material has a maximum cell size of about 50 microns.

86. (New) The method of claim 11, wherein the microcellular polymeric material has a void fraction of less than about 50%

87. (New) The method of claim 11, wherein the microcellular polymeric material has a void fraction of less than about 20%

88. (New) The method of claim 11, wherein the microcellular polymeric material is essentially closed-cell.

89. (New) The method of claim 11, wherein the microcellular polymeric material has a moisture absorption of less than about 0.1% by weight.

90. (New) The method of claim 11, wherein the blowing agent concentration is less than about 4% by weight based on the weight of the polymeric material and blowing agent solution.

91. (New) The method of claim 90, wherein the blowing agent is carbon dioxide and the polymeric material is substantially free of a nucleating aid.

92. (New) The method of claim 11, wherein the blowing agent concentration is less than about 2% by weight based on the weight of the polymeric material and blowing agent solution.

93. (New) The method of claim 92, wherein the blowing agent is carbon dioxide and the polymeric material is substantially free of a nucleating aid.

94. (New) The method of claim 11, wherein the blowing agent concentration is less than about 0.5% by weight based on the weight of the polymeric material and blowing agent solution.

95. (New) The method of claim 94, wherein the blowing agent is nitrogen and the polymeric material is substantially free of a nucleating aid.

96. (New) The method of claim 11, wherein the polymeric material is substantially free of a nucleating aid.

97. (New) The method of claim 11, comprising forming the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel.

98. (New) The method of claim 97, further comprising cooling the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel.

99. (New) The method of claim 11, comprising:

forming the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel;

cooling the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel; and

nucleating the single-phase solution by passing the single-phase solution through a nucleating pathway in a die and releasing from the die into ambient conditions a microcellular polymeric material.

100. (New) The method of claim 99, wherein the pressure after the point of blowing agent injection and prior to nucleating the single-phase solution varies by no more than about 1500 psi.

101. (New) The method of claim 99, wherein the blowing agent is carbon dioxide and polymeric material is polystyrene.

102. (New) The method of claim 11, comprising introducing, into the stream of polymeric material, the blowing agent through at least 10 orifices.

103. (New) The method of claim 11, wherein the pressure after the point of blowing agent injection and prior to nucleating the single-phase solution varies by no more than about 1500 psi.

104. (New) The method of claim 11, further comprising dividing the single-phase solution into separate portions and separately nucleating the separate portions in respective nucleating pathways.

105. (New) The method of claim 11, wherein the blowing agent comprises carbon dioxide.

106. (New) The method of claim 11, wherein the blowing agent comprises nitrogen.

107. (New) The method of claim 11, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 1.0 GPa/sec to create sites of nucleation.

108. (New) The method of claim 11, comprising continuously extruding microcellular polymeric material as a coating around a wire.

109. (New) The method of claim 108, wherein the coating is less than about 4 mm.

110. (New) The method of claim 108, wherein the coating is less than about 0.1 mm.

111. (New) The method of claim 108, wherein the blowing agent comprises carbon dioxide or nitrogen.

112. (New) The method of claim 11, comprising introducing, into the stream of polymeric material, the blowing agent through a plurality of orifices.

113. (New) The method of claim 40, further comprising releasing the nucleated single-phase solution from the die into ambient conditions.

114. (New) The method of claim 40, wherein the nucleating pathway is a single nucleating pathway.

115. (New) The method of claim 18, further comprising nucleating the single-phase solution to form a polymeric foam material

116. (New) The method of claim 18, further comprising:

nucleating the single-phase solution at a rate sufficient to form a microcellular polymeric material; and

forming a microcellular polymeric material.

117. (New) The method of claim 116, wherein the microcellular polymeric material includes cells of size less than about 100 microns.

118. (New) The method of claim 116, wherein the microcellular polymeric material has an average cell size of less than about 50 microns.

119. (New) The method of claim 116, wherein the blowing agent is present in the single-phase solution in an amount less than about 80 percent saturation concentration as determined at the lowest pressure in the extruder barrel after the point of blowing agent injection and prior to nucleating the single-phase solution.

120. (New) The method of claim 116, wherein the blowing agent concentration is less than about 4% by weight based on the weight of the polymeric material and blowing agent solution.

121. (New) The method of claim 120, wherein the blowing agent is carbon dioxide and the polymeric material is substantially free of a nucleating aid.

122. (New) The method of claim 116, wherein the blowing agent concentration is less than about 2% by weight based on the weight of the polymeric material and blowing agent solution.

123. (New) The method of claim 122, wherein the blowing agent is carbon dioxide and the polymeric material is substantially free of a nucleating aid.

124. (New) The method of claim 116, wherein the blowing agent concentration is less than about 0.5% by weight based on the weight of the polymeric material and blowing agent solution.

125. (New) The method of claim 124, wherein the blowing agent is nitrogen and the polymeric material is substantially free of a nucleating aid.

126. (New) The method of claim 116, wherein the polymeric material is substantially free of a nucleating aid.

127. (New) The method of claim 116, comprising forming the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel.

128. (New) The method of claim 127, further comprising cooling the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel.

129. (New) The method of claim 116, comprising:

forming the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel;

cooling the single-phase solution in the polymer processing space between the rotating screw and the extruder barrel; and

nucleating the single-phase solution by passing the single-phase solution through a nucleating pathway in a die and releasing from the die into ambient conditions a microcellular polymeric material.

130. (New) The method of claim 129, wherein the pressure after the point of blowing agent injection and prior to nucleating the single-phase solution varies by no more than about 1500 psi.

131. (New) The method of claim 116, wherein the pressure after the point of blowing agent injection and prior to nucleating the single-phase solution varies by no more than about 1500 psi.

132. (New) The method of claim 116, wherein forming the microcellular polymeric material comprises extruding microcellular polymeric material as a coating around a wire.

133. (New) The method of claim 132, wherein the coating is less than about 4 mm.

134. (New) The method of claim 132, wherein the coating is less than about 0.1 mm.

135. (New) The method of claim 116, further comprising dividing the single-phase solution into separate portions and separately nucleating the separate portions at a rate sufficient to form a microcellular polymeric material.

136. (New) The method of claim 135, further comprising re-combining the separate portions.

137. (New) The method of claim 136, comprising forming the microcellular polymeric material from the re-combined separate portions.

138. (New) The method of claim 70, wherein the microcellular polymeric material forms an article having a thickness of less than about 4 mm.

139. (New) The method of claim 18, comprising introducing, into the stream of polymeric material, the blowing agent through at least about 100 orifices.

140. (New) The method of claim 18, further comprising dividing the single-phase solution into separate portions and separately nucleating the separate portions.

141. (New) The method of claim 18, wherein the blowing agent comprises carbon dioxide.

142. (New) The method of claim 18, wherein the blowing agent comprises nitrogen.

143. (New) The method of claim 18, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

144. (New) The method of claim 18, wherein the same type of blowing agent is introduced through each of the ports.